

# Redwood

National and State Parks

National Park Service  
US Department of the Interior

Department of Parks and Recreation  
State of California

## 2008 HERD UNIT CLASSIFICATION OF ROOSEVELT ELK



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## INTRODUCTION

Roosevelt elk (*Cervus elaphus roosevelti*), the largest of the six subspecies of elk, are endemic to the redwood forest ecosystem, and associated ecosystems such as oak woodlands and grasslands and coastal dunes, in northwestern California. Prior to settlement by Europeans and other foreigners in the 1850s Roosevelt elk were hunted by Native Americans, presumably with minimal impact to the population. The tribe living in and around what is now Redwood National Park, the Chilula, burned the prairies of the Bald Hills regularly in part to promote the growth of new grass attractive to wildlife (i.e., elk and deer). Beginning in 1848 and continuing to 1855 market hunting for elk hide and meat to supply gold miners during the northern California gold rush significantly reduced elk populations and distribution (USDI 1983). When the gold rush was over non-Native American settlement began and a large amount of elk habitat was converted to cattle and sheep ranching and crop lands.

The only Roosevelt elk populations that persisted through this period were those occupying coastal lowlands in the northern part of California, where dense forests and brush fields provided protective cover. Dasmann (1964) speculated that the total elk population of northern California ranged from 1,000 to 2,000 animals. Mandel and Kitchen (1979) estimated the elk population to be 1,000 to 1,300, with roughly half being located in and around Redwood National and State Parks (RNSP or “parks”). One objective of resource management in RNSP is to restore elk herds to pre-settlement numbers and allow the population to be in equilibrium with the environment, regulated only by predation, inter- and intra-species competition, and other natural phenomena (USDI 1994).

Annual classification of elk herds within RNSP began in 1996 to document relative abundance and simple population characteristics, such as cow numbers, recruitment, and calf survival within known herds (Wallen 1997). These herd count/classifications have been conducted annually each fall since that time. Also in 1996 a monitoring program of the elk population in a portion of the Prairie Creek drainage was established independent of the RNSP program (Weckerly 1996, Weckerly et al. 2004). The execution of 2 independent monitoring programs in the same area provided a unique opportunity to compare data gathered opportunistically with data gathered using a systematic approach. Weckerly and Francis (2004) found that counts of cow groups in the Prairie Creek drainage were similar from 1997 to 2003 between RNSP and Weckerly, but herd composition ratios were not. Weckerly and Francis (2004) suggested this may be due to observer bias in classifying calves.

In 2004 the “Weckerly method” (Weckerly and Francis 2004) of counting elk in the Bald Hills was implemented for the first time. This method differed from the more opportunistic method used in previous years by park staff. Unlike the Prairie Creek herd counts, the Bald Hills herd counts were very dissimilar between the staff’s and Weckerly’s, with staff counts grossly undercounting the numbers of animals. Since 2006 Dr. Weckerly has been conducting the Bald Hills counts each January and due to the nature of the park staff counts, we’ve discontinued our fall counts in the Bald Hills.

## METHODS

Seven separate herds were counted/classified within RNSP. Six of the herds were counted by RNSP staff during the period between late September and November. The Bald Hills herd (made up of several herds that co-mingle at times and therefore are not considered separate herds) was counted in January of 2009 by Dr. Floyd Weckerly. The Prairie Creek herd monitoring program, conducted by Dr. Weckerly, uses an established survey route and surveys were conducted in January. Results from these latter two surveys are considered part of the 2008 elk count “season” and are included in this report with the 2008 data. This is compatible with how this information was reported in previous reports.

Herd visits in the fall generally occurred every other week according to a schedule, however, some counts were made opportunistically while doing other field work. Classification counts were performed by driving or hiking to the identified herd units. Using binoculars and spotting scopes RNSP staff recorded the total number of elk observed, and the total number of elk within each classification group. The groups are mature bulls, spikes (first year males identified by a lack of brow tine off the main beam), cows, and calves. The observers also assigned ranking criteria to the classification counts that specified the observer’s confidence in the count data. A scale of one to four was used to determine the certainty of the observation. A rating of 1 indicated good visibility and the animals were close enough to observe with confidence an accurate count and herd classification. A rating of 4 indicated that the observation was unacceptable for determining herd composition because of poor visibility due to low light level, fog, vegetation, or topography. In calculating the ratio of calves to adult cows, ratings of 3 and 4 were dismissed due to poor quality of observations. The cow count with the highest ranking was used as the herd size estimate for 2008 as in previous years.

During the winter survey in the Bald Hills the elk were counted from vantage points or they were approached on foot and counted. A set transect route was driven/walked once a day 10 times within a 12 day period. When groups were approached on foot it was to obtain an unobstructed view or to conduct a coordinated stalk. A coordinated stalk consisted of an attempt to alert elk groups to the presence of one surveyor in such a manner that the group walked to an area with an unobstructed view where they could be counted by another surveyor. All elk seen were counted and classified into mature bulls or “cows” using binoculars and field telescopes. Juveniles and spikes were combined with females because these age-sex classes were not detected by themselves. All animals within 50 m of one another displaying coordinated activity or movement was considered a herd (Weckerly et al. 2004). All discrete sub-herds seen during one survey day were lumped into a single number representing the entire Bald Hills herd. As with the other herd counts, the highest reliable cow count was used as the year’s herd size estimate for this season. Winter survey routes are displayed in Appendix A.

### *Fall Count Herd Units*

- (1) **Old South Operations Center (OSOC)** herd
- (2) **Lower Redwood Creek (LRCR)** herd (sometimes referred to as the “Levee” herd in previous reports)

- (3) **Davison Ranch**/Berry Glen (DARA) herd
- (4) **Elk Prairie**/Hwy 101 Bypass herd (EPBY)
- (5) **Gold Bluffs Beach** (GOBB) herd(s); (several co-mingling herds)
- (6) **Crescent Beach Education Center** (CBEC) herd

#### *Fall Count Herd Classification Groups*

- **Cows** = all females >1 year old.
- **Calves** = young of the year (<1 year old; recognized by spotted coat and small size; later the spots disappear, but they retain a short, rounded snout.)
- **Spikes** = year old males exhibiting only a main beam, brow line absent.
- **Mature bulls** =  $\geq 2$  years, with brow line evident off the main beam.

#### *Fall Count Herd Observation Ranking Criteria*

- 1 = Good**, visibility good and animals close enough to observe with high confidence of an accurate count and classification.
  - 2 = Fair**, animals are either distant or not fully cooperative for good confidence in classification (e.g. some vegetation blocking full view or movement into cover while counting).
  - 3 = Poor**, animals too far away (e.g. difficult to track individuals or animals are in adjacent hiding cover).
  - 4 = Unacceptable**, bad visibility due to low light levels, fog, uncooperative animals.
- All of the ranked observations are briefly summarized in the notes section of the data form.

## RESULTS

Fall classification counts (and winter 2009 for Bald Hills) for the different age classes are presented in Table 1. It should be noted that Weckerly (unpub. data) counts the “Prairie Creek” herds, equivalent to our DARA and EPBY herds combined, and reported a population estimate (from January 2009) of 52 (95% CI = 49 -56) from these two sites. In contrast, our high count of 41 for the two herds was lower than the lower CI limit calculated by Weckerly. Reasons for this difference are unknown; in previous years staff herd counts have tracked reasonably close with Weckerly’s population estimate for these herds (Weckerly and Francis 2004).

**Table 1.** Highest number of elk reported within each herd unit and for each classification grouping in 2008. MB = mature bull, SP = spike, CW = cow, CV = calf, n = total surveys.

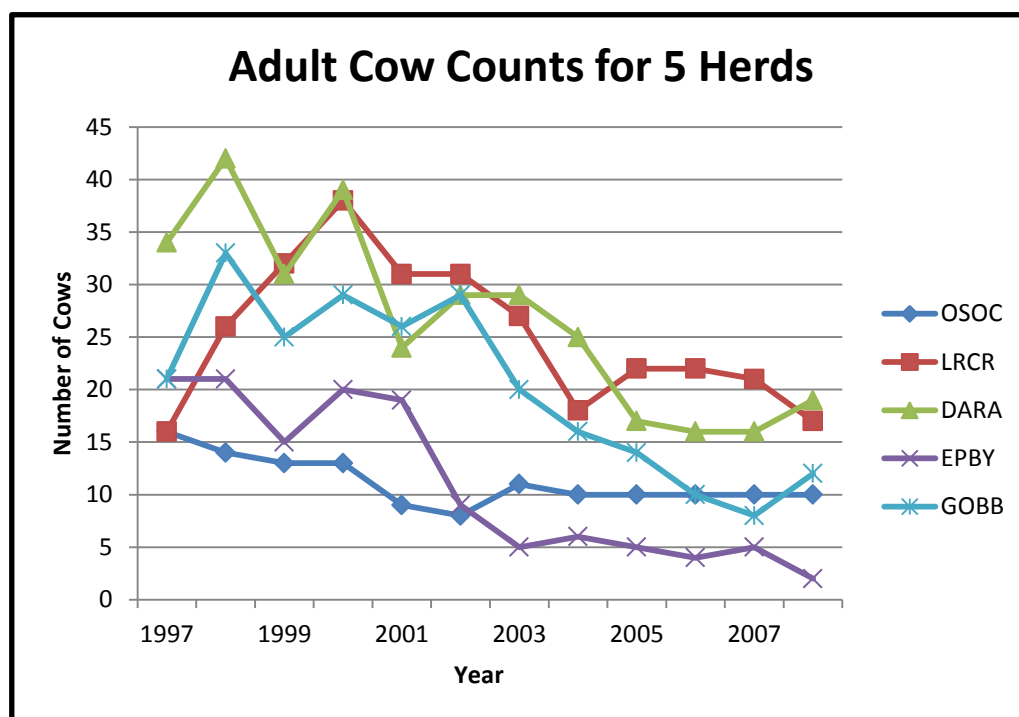
<b>Location</b>	<b>MB</b>	<b>SP</b>	<b>CW</b>	<b>CV</b>	<b>Total</b>	<b>n</b>
OSOC	2	1	10	4	17	2
LRCR	2	5	17	4	28	4
Bald Hills <sup>1</sup>	16	N/A	244	N/A	260 <sup>2</sup>	10
DARA	5	4	19	7	35	3

Location	MB	SP	CW	CV	Total	n
EPBY	1	1	2	2	6	2
GOBB	2	2	12	6	22	4
CBEC	5	2	15	6	28	4

<sup>1</sup>Only mature bulls were classified, all other elk classifications (spikes, cows, calves) were lumped together under the cow heading as directed by Weckerly and Francis (2004).

<sup>2</sup>There were two sub-herds in 2008: Counts/Childs with 24 cows and 11 bulls and Coyote Creek with 220 cows and 5 bulls.

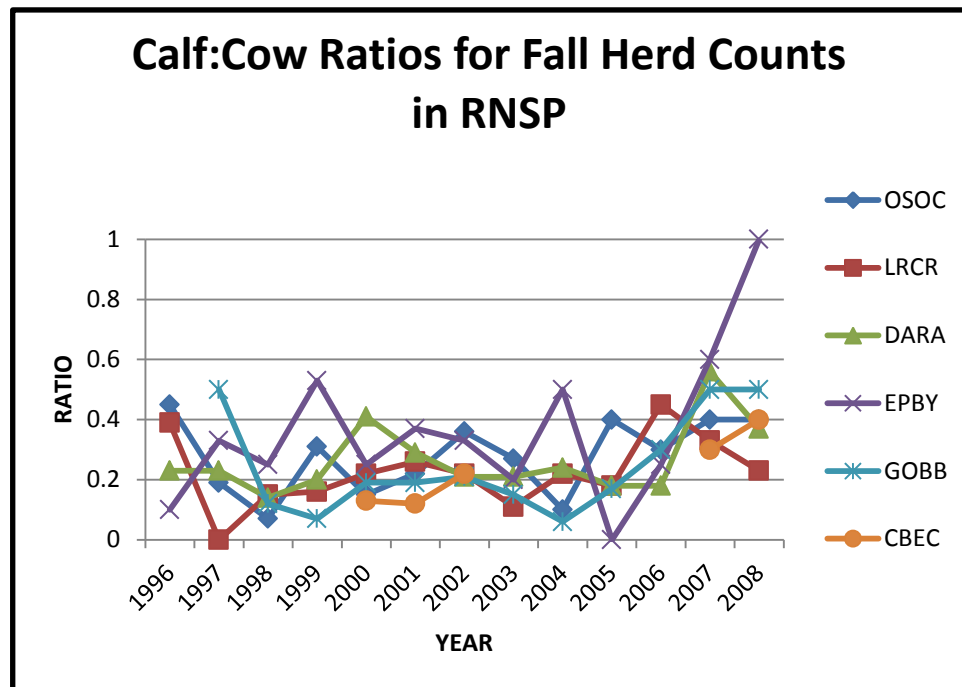
Cow counts by year, the best indicator of herd persistence (Weckerly and Francis 2004, McCullough et al. 1994), are displayed in Fig. 1 with numbers for all herds provided in Appendix B. Other than the OSOC herd and the Bald Hills herd not reported here a steady downward trend in cow numbers appears to be occurring for the remaining 5 consistently monitored herds in the parks.



**Figure 1.** Selected RNSP elk herd cow numbers from 1997 to 2008 indicating herd persistence through time. The CBEC herd is not included due to lack of count data for the majority of years.

The highest fall cow count in each herd was used to determine calf:cow and bull:cow ratios. The ratio of calves to cows is an indication of herd productivity, and has remained fairly consistent since counting began with the exception of the EPBY herd (Fig. 2 and Table 2). The high calf:cow ratios in 2004, 2007, and 2008 for this herd are artifacts of an extremely small population size. For example, in 2008 the high count consisted of two cows observed, each with a calf, resulting in a one to one calf:cow ratio. Note that in 2005 zero calves were observed (F.

Weckerly pers. comm.). Weckerly (unpub. data) calculated a calf:cow ratio of 0.55 for both the Elk Prairie/Bypass and Davison herds combined during this count season.



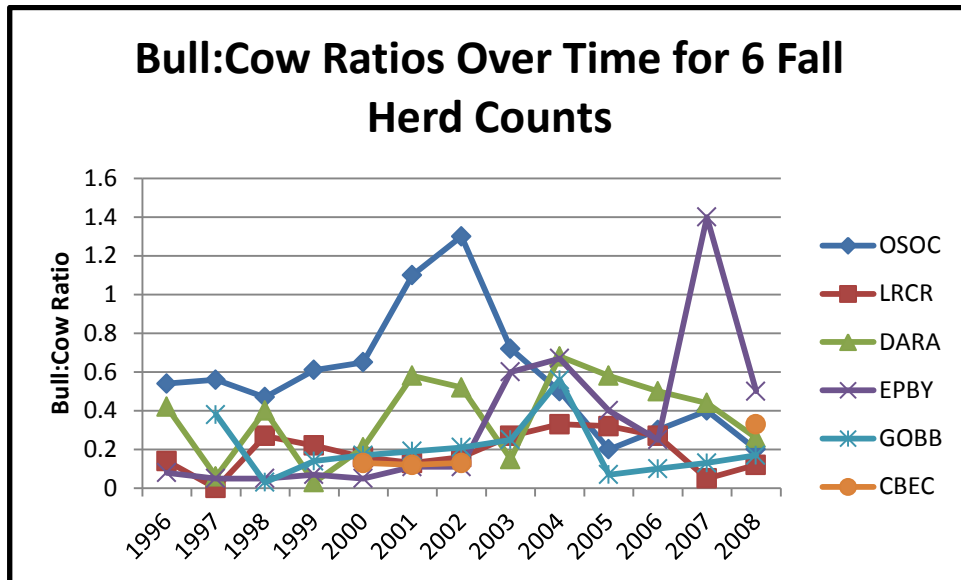
**Figure 2.** Calf:cow ratios from 1996 to 2008 indicating herd productivity through time. The CBEC herd was not counted consistently every year.

**Table 2.** Calves per 100 cows for fall elk herd counts, 1997 to 2008.

Location	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
OSOC	35	29	31	15	22	36	27	10	40	30	40	<b>40</b>
LRCR	11	15	38	22	26	22	11	22	18	45	33	<b>23</b>
DARA	27	18	23	41	29	21	21	24	12	18	56	<b>37</b>
EPBY	33	24	53	29	37	33	20	50	0	25	60	<b>100*</b>
GOBB	38	12	7	9	19	21	15	6	17	30	50	<b>50</b>
CBEC	N/A	N/A	N/A	13	12	22	N/A	N/A	N/A	N/A	30	<b>40</b>

\*This number is inflated due to the fact that the two cows observed each had a calf.

One reason for monitoring bull:cow ratios is that these ratios may indicate quality of the forage (Weckerly 2007). Figure 3 displays the bull:cow ratios for the six herds monitored in the fall by park staff. As in the other data displayed in these results the EPBY herd data are influenced by very small cow numbers. Weckerly (pers. comm.) reported a bull:cow ratio of 0.57 (95% CI = 0.55-0.58) for the EPBY and DARA herds together.



**Figure 3.** Bull:cow ratios from 1996 to 2008 indicating herd reproductive capability through time. The CBEC herd was not counted consistently every year.

#### *Old South Operations Center (OSOC) Herd*

The number of cows in this herd has held fairly steady over the 12 years of surveys, however, it has never been as high as the number recorded during the first count in 1996. Calf production has been less consistent for this herd. Bulls, until 2003, have always been in substantially greater numbers than in the other fall herd counts; however, bull numbers dropped after 2002 and continued to decline until 2005, and as yet have not recovered to the levels observed previously. Reasons for this are unknown; perhaps forage quality has changed over the years, forcing bulls into habitat where they are less likely to be observed (Weckerly 2007).

#### *Lower Redwood Creek (LRCR) Herd*

The elk in this herd continued the trend of using a long corridor of habitat along lower Redwood Creek extending from the pastures near the Redwood Creek estuary upstream to the confluence of Cloquet and Redwood Creeks. Cow counts have stayed relatively stable for the last 4 years, yet remain lower than counts prior to 2003 (Fig. 1 and Appendix B). The calf:cow ratio was down from 2007's 0.33 which was the third highest ratio documented for this herd. The bull:cow ratio was 0.12 validating the claim that last year's small survey sample size ( $n=2$ ) could have been responsible for the low ratio, rather than a true shortage of bulls (Holm 2007).

#### *Davison Ranch (Elk Meadow) / Berry Glen (DARA) Herd*

Like the Old SOC herd, this elk herd is one of the most visible and accessible herds in the park. Classification counts were typically conducted under good visibility and the animals were often close enough to observe with a high confidence in accuracy of count and classification. The herd consists of a group of mature bulls that mainly occupies the northern portion of Elk Meadow

north to the Lost Man Creek Hatchery and a group of cows, spikes, and calves that occupy the southern portion of Elk Meadow south to Skunk Cabbage Creek. The number of cows was up over previous years although herd size was approximately the same as last year. Last year's unprecedented calf:cow ratio (0.56) fell to 0.37 in 2008. The bull:cow ratio also fell from 0.44 in 2007 to 0.26 in 2008.

#### *Elk Prairie / Hwy 101 Bypass (EPBY) Herd*

This herd count was the smallest ever recorded by park staff, although Weckerly's count was slightly higher than ours in 2008. The Hwy 101 bypass has influenced herd movements since its construction; grass planted along the wide shoulders of the highway has proved attractive to the elk which at times graze on the side of the road. There are a number of spots where elk may congregate along the bypass that are hidden from view from the highway. In places where there is good visibility it is unsafe to stop to survey. Only two cows were counted in 2008 although Weckerly counted 5. Each cow had a calf resulting in an artificially high indication of reproductive success (100%). Likewise the bull:cow ratio (0.5) also was artificially high due the few numbers of animals observed.

#### *Gold Bluff Beach (GOBB) Herd*

The Gold Bluffs Beach herd seems to be comprised of several sub-herds which come together on occasion and have been observed from Mussel Point at the south end of Gold Bluffs Beach to Carruther's Cove near the northern limit of this beach. This year 4 counts occurred; the count with the largest number of cows was near Gold Bluffs Beach campground, but surveyors failed to record the locations of the other counts, thus, it's not clear where they took place. The highest number of cows observed in this herd was 12, up from the all-time low number of 8 last year but still substantially down from the high numbers recorded between 1998 and 2002 (see Fig. 1 and Appendix B). The calf:cow ratio was 0.5, same as in 2007, indicating a relatively productive herd despite the lower number of cows (Fig. 2). The bull:cow ratio was low, as it has been in recent years.

#### *Crescent Beach Education Center (CBEC) Herd*

Interpretation staff stationed at CBEC recorded elk in the meadows near CBEC throughout much of the year. To be consistent with the other counts reported here, only numbers recorded in fall (September through November) were used. The cow count was the lowest it's been in the years where counting occurred (2000, 2002, and 2005-2008), however, this herd may split at times into sub-herds, as there was a high count of 32 cows in late November and December but there was some question as to the accuracy of the cow/calf classifications in the larger counts. The calf:cow ratio was 0.40, up from last year's ratio of 0.30. The herd has been observed using pastures on the east side of Hwy 101 above CBEC and crossing the highway to the west above CBEC. There also was a note by a CBEC observer stating "this group split; first January '09 sightings were only a small group of 7- one spike/ 6 cows".



### *Bald Hills Herd*

In early 2009 elk groups in the Bald Hills appeared to be comprised of two discrete herds that were observed and categorized by Weckerly (2009 unpub. data) as the Counts Hill/Childs Hill herd and the Coyote Creek area/Stover's herd. There was one instance, in early October 2008 when park staff counted a group of 20 near Elk Camp. Together the two groups accounted for the highest number of animals recorded since the Weckerly method of counting was begun in 2004 (total 260;  $n = 10$ ). Calf:cow ratios were calculated only for the small group observed (i.e., Counts/ Childs) due to the difficulty of classifying animals in large groups. In 2009 the ratio was 0.15 (95% C.I. 0.14-0.16) (Weckerly unpub. data). Due to the lumping of cows, calves, and spikes into the "cow" group, bull:cow ratios were not able to be calculated.

### *Other Observations*

Opportunistic visitor and staff observations were limited to six reports. A group of 7 (4 cows, 2 bulls, and 1 "juvenile") were reported by visitors on Miner's Ridge Trail on 18 September with the comment "bull was very aggressive". Three elk were encountered by visitors along Trillium Falls Trail on 26 June with the comment "threatened and going to charge but didn't". One would assume this included an encounter of a cow with one or two calves. Lone animals were reported from the pasture north of the Redwood Creek north slough and at the Gold Bluffs Beach kiosk. Six animals (most likely from the OSOC herd) were reported along West Side Access Road and a group of 15 were observed by park staff in the dunes south of Ossagon.

### *Mortality and other Incidents*

In 2008 one elk carcass was discovered in the northern portion of Davison Ranch which had been predated, most likely by a mountain lion. Another badly decomposed carcass was found in Boyes (Elk) Prairie, the cause of death in this case was unknown, although a bear was observed dragging a dead elk across the Newton B. Drury Parkway. There was one documented case of poaching in the park near the Redwood Creek Trailhead in March. Also in March a young female was in the middle of a herd of cattle on ranchlands near Orick. The cattle posed a threat to this animal so it was sedated and relocated to the Bald Hills with the assistance of California Department of Fish and Game (CDF&G) personnel. In August a young bull elk entangled its antlers in some type of wire fencing near the Orick Rodeo Grounds; the fencing was removed by a CDF&G biologist (Fig. 4).



**Figure 4. Young bull elk with wire entangled in its antlers which was later removed.**

## DISCUSSION

Based on the count numbers, RNSP elk productivity appeared comparable to previous years although cow counts have steadily declined (with the exceptions of the OSOC and Bald Hills herds) since the late 1990s/early 2000s. The downward trend in cow numbers has been occurring for the past four to five years, depending on the herd. The DARA, EPBY and GOBB herds have more than halved in size over the past six years with the EPBY herd at its lowest level recorded. It should be noted that the calf:cow ratios presented in this report do not reflect how many calves were born, but simply how many survived until the fall.

Future monitoring, especially of the EPBY and DARA herds, should help indicate whether this trend is merely a temporary fluctuation or an actual, and permanent, decline. The cause of the decline in these herds is unknown and only speculative hypotheses have been considered, including deaths of cows through vehicle collisions, poaching, increased predation, a change in quality of forage or an over-abundance of food resources coincidental with initial counts (F. Weckerly pers. comm.) or a combination of these. According to Weckerly (2007) where animals are easily sighted in forage habitat and difficult to sight in habitat with less food, food limitations should affect sightings of males but not females. The converse is true when food is abundant; males and females are sighted equally in forage habitat. Perhaps this explains some of the observed fluctuations in bull:cow ratios over the years.

However, food supply alone does not explain the low numbers of cows at Boyes (Elk) Prairie. Based on preliminary data from a study in progress, forage continues to be of high quality in Boyes Prairie, even when compared to the adjacent Davison Ranch/ Elk Meadow area (F. Weckerly pers. comm.). It is unlikely that the large numbers of animals observed in the EPBY herd in previous years still exist. Opportunistic surveys by RNSP staff have recorded elk only in very small numbers along the Hwy 101 bypass in the past 7 years, coincidentally about the time

of construction of the median barrier along the south end. Dr. Weckerly (pers. comm.) suspects the decline of this herd is coincidental with barrier installation on the bypass, and that the presence of the bypass has caused elk declines either due to increased vehicle collisions, increased poaching opportunities or both. Only targeted research may provide definitive answers but if the steady declines in the lowland herds continue, park managers should seriously consider making this issue a research and management priority.

Table 3 demonstrates the huge differences in herd numbers from over three decades ago versus today, even if the exactness of the counts is somewhat unknown. Large herds were observed in Boyes Prairie and Gold Bluffs Beach areas in the past (Stevens 1965, Lieb 1973, Kitchen and Mandel 1979).

**Table 3. Roosevelt elk herd estimates from previous studies in RNSP.**

<b>Year</b>	<b>Estimate</b>	<b>Source of Information</b>
1965	170 - Prairie Creek Redwoods SP 80 - Gold Bluffs Beach	Stevens 1965
1973	200-250 in Prairie Creek Redwoods SP, Gold Bluffs Beach and ARCO cutover lands surrounding Prairie Creek SP	Lieb 1973
1979	580 (195 in the Prairie Creek and Gold Bluffs Beach areas combined)	Mandel and Kitchen 1979

Calf to cow ratios provide a relative index of reproductive success. Calf:cow ratios reported by Mandel and Kitchen (1979) were 17 and 31 calves per 100 cows for the two years they calculated this statistic. These authors combined all data gathered in and around RNSP. Stevens (1965) noted 30 calves per 100 cows at Prairie Creek Redwoods State Park (PCRSP). Lemos (1971) reported 25 calves per 100 cows on the ARCO cutover lands just south of PCRSP. By comparison, staff counts averaged 27.2 ( $\pm$  12.1 sd) calves per 100 cows at DARA and 22.8 ( $\pm$  15.7) at GOBB between 1997 and 2008 indicating that despite herd size decline productivity has remained fairly stable. However, approximately 30 to 40 calves per 100 cows was the range observed for Rocky Mountain elk on the National Elk Refuge during mid-winter after the herd unit went through a hunting season in 1995 (B. Smith, pers. comm.).

In the small sub-herd in the Bald Hills (Counts Hill/Child Hill) in 2009 Weckerly (pers.comm.) estimated 15 calves per 100 cows; this herd may be subject to hunting pressure as it is on the border with private land where a hunt takes place each year. This herd also may be subjected to increased amounts of poaching due to its proximity to Bald Hills Road; we have documented poaching events in the prairies on a number of occasions over the past few years. Hunting pressure also may be responsible for some of the smaller herd declines in coastal areas in recent years. In 2006 the Northwestern Hunt was initiated; 20 tags are issued for this hunt that allows

private landowners to grant access for the purpose of hunting elk on their property. Landowners in the Orick Valley may allow hunting that could impact the OSOC and LRRC herds. The Klamath Hunt, which takes place annually on Green Diamond Resource Company lands adjacent to the park, could be impacting the EPBY herd and possibly what may be a sub-herd of the GOBB herd; animals were known to use upland areas in northern Prairie Creek Redwoods State Parks in years past (e.g., Mandel and Kitchen 1979; unpub RNSP data).

Another factor in some of the herd declines may be due to increased predation, primarily by mountain lions. Lions have been protected in California since 1990 and although there're no actual data to support the notion that lion numbers have increased since then, there is indirect evidence that numbers have increased, e.g., numbers of reported "encounters" and depredation permits issued (see CDF&G website). In 2005 and 2006 alone there were five documented lion-killed elk within the parks in areas easily observed by people. It stands to reason that lions are may be taking elk in equal numbers in remote locations as well.

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#### PERSONAL COMMUNICATION

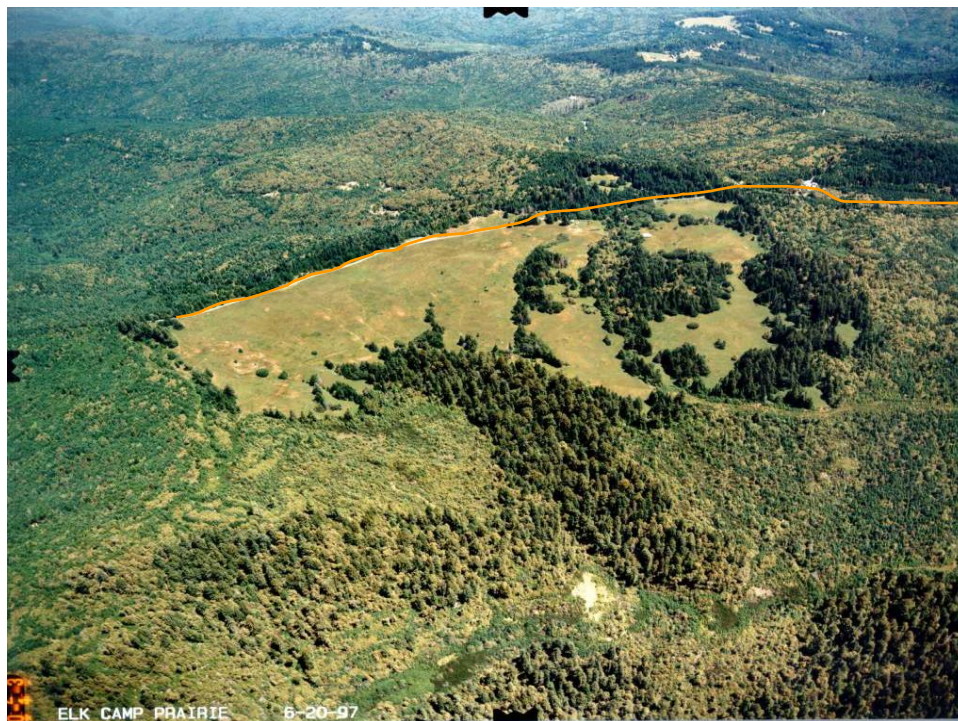
Dr. Floyd "Butch" Weckerly, Assistant Professor, Texas State University, San Marcos, TX

Bruce Smith, National Elk Refuge, Jackson WY



## Appendix A

The following 6 aerial photos show the winter Bald Hills elk herd survey route (indicated by yellow line) from the Elk Camp Prairie to the Coyote Creek drainage along the Bald Hills and K & K Roads:



1. Elk Camp Prairie



2. Lower Dolason West/ West Upper Dolsason/ Lower Dolason East/ East Upper Dolason





3. Upper and Lower Airstrip/ Upper and Lower Counts Hill

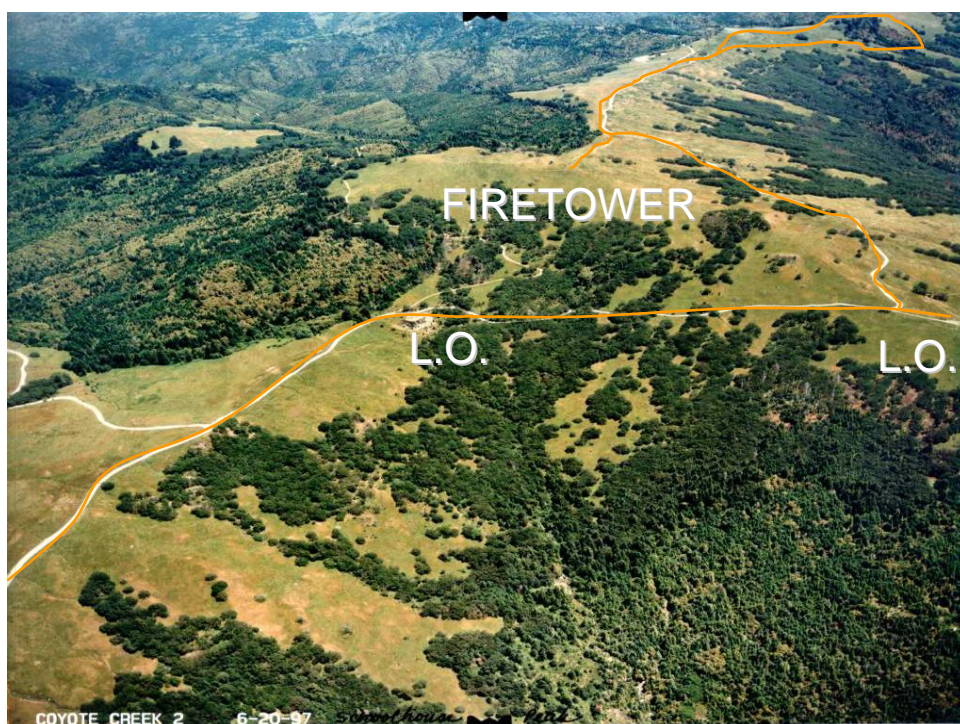


4. Maneze/ Childs Hill





5. Childs Hill



6. Coyote Creek

## Appendix B

**Highest reliable (ranking <3) cow counts for identified elk herds, 1997 to 2008 (data displayed [in part] in Figure 1 in the report).**

<b>Location</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>
OSOC	16	14	13	13	9	8	11	10	10	10	10	10
LRCR	16	26	32	38	31	31	27	18	22	22	21	17
BAHI	45	98	62	104	54	35	26	241*	251*	278*	270*	244*
DARA	34	42	31	39	24	29	29	25	17	16	16	19
EPBY	21	21	15	20	19	9	5	6	5	4	5	2
GOBB	21	33	25	29	26	29	20	16	14	10	8	12
CBEC	ND	ND	ND	16	ND	23	ND	ND	30	23	27	15

\* Counts conducted using the “Weckerly method” account for differences in herd counts beginning in 2004.